ELECTRICAL ISOLATION PROCEDURE

TAKREER Project No. : 5578

DISTRIBUTION	
TAKREER	
SEOUL	
SITE	V
PMC	
SEOUL	
SITE	V
CONTRACTOR	
PROJECT	V
PROCESS	V
PIPING	V
ROTATING	V
STATIONARY	V
ELECTRICAL	V
INSTRUMENT	V
CIVIL	V
ARCHITECTURE	
PROCUREMENT	V
CONSTRUCTION	V
QA / QC	V
HSE	V
IT	V

TAKREER

Ruwais Refinery Expansion Project

Rev	Date	Description	Orig by	Chk'd by	App By	COMPANY App
0	31/01/13	For Construction	G.T.W.	Y. H YANG	I.H.Hur	
E	15/01/13	For Approval	G.T.W.	Y. H YANG	I.H.Hur	
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ABU DHABI OIL REFINING COMPANY (TAKREER)

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A	22. Sep. 12	Originally issued for Review and Comment	All	
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D	03. Jan. 13	Comments Incorporated		
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0	31. Jan. 13	Issued for Construction		

AGREEMENT

By EPC CONTRACTORS Seal and EPC CONTRACTORS representative signature hereunder attached, it is recognized and covenanted by the Parties hereunder that a formal Agreement has been made regarding the works as described in this Common Water Flushing Procedure. This Agreement has been mutually signed and agreed

	EPC 1	EPC 2	EPC 3	EPC 4	EPC 6	EPC 7
Name						
Position						
Signature						
Date						

موت ماكدونالد ليمتد Abu Dhabi ابوظبي MOTT MACDONALD LIMITED

Contents

1.0 Purpose

The purpose of this document is to ensure safety at work of all personnel and equipment provide, together with details of methods and principles for safe Electrical Isolation of equipment.

2.0 Scope

This document is applicable for the Pre-Commissioning, Commissioning and Start-Up periods, for all who may work on High and Low Voltage Electrical Systems in RRE.

3.0 Definitions

- Working party - Party with authority to operate and work on Electrical equipment.
- Shift Authority – A nominated individual with authority to control a shift.
- Senior Authorised Electrical Person – An Experienced individual with authority to work on all Takreer electrical installations.
- Authorised Electrical Person – An individual with skills that allow them to operate electrical equipment.
- Competent Electrical Person - a person with suitable experience, knowledge to work within this discipline.

4.0 Responsibilities

4.1 CONTRACTOR Commissioning Manager

The Commissioning Manager is responsible for all Commissioning operations on RRE.
He is responsible for:

- Electrical safety management of commissioning at site.
- Reports to Site Manager.
- Coordination with all disciplines personnel related with project Pre –comm. / Comm. / start up matters/Energisation /electrical isolations.
- Coordination & meeting with COMPANY, vendors, licensors & other related parties.
- General responsible for preparations and executions of Electrical Isolation activities.
- Establishes project comm /Energisation /electrical isolations /start up execution plans including budget, organization & mobilization schedule, electrical team & other preparations.
- Assign adequate & competent staff according to the procedures.
- Ensure this procedure is implemented within their work areas.
- Ensur e that electrical isolations are carried out by Authorized Responsible Persons in accordance with this procedure.
- Ensures that all activities in the site are carried out as per Takreer's guidelines.

4.1.1 Area Authority

Each area Operation Supervisor is designated by Commissioning Manager as a Area Authority.

The Area Authorities are responsible for:

- Ensuring that all procedures and safeguards are fully implemented.
- Facilitating preparatory works in connection with work permits.
- Ensuring that equipment is operational after maintenance works are completed

4.3 Electrical Safety Supervisor

The Electrical Safety Supervisor is responsible for:

- Conducting periodic checks on status of isolations and conformance with this Procedure.
- Providing advice and / or assistance as requested / when required.

4.1.2 Authorized Electrical Persons

Authorized Electrical Persons consist of three levels with the approval of Commissioning Manager.

- Senior Authorized Electrical Person / Authorized Electrical Person/ Competent Electrical Person.

The Authorized Electrical Person is responsible for:

- Performing electrical isolations as requested on Electrical work Permit and within the limits of their authorization.
- Demonstrating to Operators and Working Party that concerned equipment will not /cannot start under any conditions or circumstances.
- Reinstating switching equipment to normal on completion of works.
- Participating in test runs with Operators and Working Party before cancellation of Permit to Work.

5.0 Procedures

5.1 General

Requests to electrically isolate equipment, or a package, is made by the Working Party when first raising the Permit to Work, by filling in Box A of the Electrical Work Permit. In the particular case of generators, a Process / Isolation Confirmation Certificate must also be raised.

All equipment subject to electrical isolation must be padlocked by using a safety padlock the

number of which must be mentioned on the Isolation Certificate.

If there are several Permits to Work raised for the same item of equipment to be electrically isolated, there must be the same number of safety padlocks applied.

This Procedure is to give guidance to Authorized Electrical Persons in charge of electrical isolation.

5.2 Electrical Isolation Principles

Electrical Isolation is a preparatory operation to allow a Permit to Work to be issued and to ensure that general safety precautions are observed when carrying out the isolations.

General safety precautions are:

- Correct Personal Protective Equipment (PPE) must be worn, which will be defined in the Method Statement and TRA.
- Make sure that any equipment to be isolated is at a stop.
- Check scope of work on equipment to be isolated: if equipment removal is contemplated, cables must be disconnected at concerned equipment and cable ends capped using approved material such as heat shrinkable tube to prevent damage to connections or moisture ingress.
- Apply safety padlocks where necessary to ensure proper isolation
- Log safety padlock numbers and document numbers in the sub-station Log Book provided for this purpose.
- As safety padlocks have a unique key, they must be stored in the sub-station key-box to avoid risk of loss.
- Provide, wherever necessary, a multi-locking device to allow for fitting of several Padlocks with different colour.
- Demonstrate to Shift Authority and to Working Party (if present) that equipment will not /cannot start under any conditions or circumstances.

A tag shall be placed at the isolation point with padlocks and the tag must include a clear description of the reason for the equipment isolation, the name of the person , the time and date.

5.3 HV Equipment Isolation

5.3.1 Motor Feeders

There are two types of HV motor feeders:

- 11 kV motors fed from ----------

- 3.3kV motors fed from 3.3 kV switchboards through vacuum contactor.

Depending on the work to be done on equipment, isolation may consist only of locking-off the main control device. If any work is required on conductive parts however, earthing of HV cables is mandatory in addition to locking-off.

Control device locking-off consists of racking out the withdrawable breaker in order to separate it from bars, although not necessarily removing it from the cubicle, and fitting safety padlock(s) at appropriate location(s) in such a way that racking-in is impossible without removing the safety padlock.

Locking-off isolation is only performed by an Authorized Electrical Person.

Earthing of HV cables is achieved by closing the earth-switch associated with the circuit breaker / contactor and locking-off in the closed position with a safety padlock.

This type of isolation (locking-off and earthing) is performed by an Authorized Electrical Person who issues a Electrical Work Permit describing the work to be done by electrical personnel on conducting parts.

If work by electrical personnel is to disconnect the motor to allow removal by others (mechanical engineers, for example), this is part of the preparatory work and must be done with issuing Electrical Work Permit.

In some cases the works to be done on such feeders may be performed by electricians.
In these cases the Electrical Permit To Work shall be issued by the Shift Authority before effective electrical isolation is done but equipment must be at stop.

5.3.2 Distribution Transformer Feeders

There are four types of distribution transformers:

- 33 kV to 11 kV
- 11 kV to 3.3 kV
- 11 kV to 415 V
- 3.3 kV to 415 V

These transforms differ in that the secondary sides of the latter ones are not provided with earthing facility at switchboard level.

Before isolation is performed, all require that some switching is done to ensure that the busbars they are supplying are fed from another source.

All switchboards are equipped with a bus-tie circuit breaker which must be closed before opening the feeder / incomer to be worked on.

For this operation, the Shift Authority or Working Party (if a Permit to Work is issued) must ensure that any switching is done from the Switchgear Incoming Panel located in each Substation before effective isolation is started thus avoiding disturbance to running equipment.

Primary circuit breaker is also to be open after the source change.

Every change in breaker position must be confirmed by radio or telephone from the concerned locations to Substation Operator.

Once this is done, the following actions may be performed at the concerned switchboards:

- Racking out of circuit breakers.
- Closure of earthing switches (on 11 kV or 3.3 KV switchboards only).
- Fitting of safety padlocks.

For 33 to 11 KV & 11 to 3.3kV transformers, access to terminals is only possible if the appropriate keys are retrieved from switchboards (keys are free when earthing switch is closed).
The same applies for 11 kV to 415 V & 3.3 kV to 415V transformers, but on the low voltage side. The key is free when the circuit breaker is racked out as there is no earthing mechanism.

This type of isolation must be performed under the supervision of a Senior Authorized Electrical Person.

Similarly for motors, if working on conducting parts to allow others to work, the Senior Authorized Electrical Person must issue a Electrical Permit to Work to describe the scope of work by electricians.

When work is to be done by electricians the work may start under the responsibility and supervision of a Senior Authorized Electrical Person (or his delegate who cannot be less than an Authorized Electrical Person) until all works on isolated equipment are complete.

Restoration to a live condition must be under the supervision of a Senior Authorized Electrical Person.

5.3.3 Generators

In order to allow safe work on packages, isolations are made at following locations:

- Electrical switchboard where power lines are connected.
- Generators where excitation controls output is located.
- Diesel oil supply line (Mechanical / Process isolations).
- Auxiliary package switchboard (depending on scope of works).

- Starting systems (Mechanical / Process and /or Electrical Isolation).

Similarly as for previous equipment, preparatory works start by bringing the machine off-line and control of main circuit breakers is to be done from the main panel.

Electrical isolations may be of the simple lock-off type when work does not involve conductive parts, otherwise earthing must be done at switchboards and at generator terminals for main generators. Package-dedicated switchboards may also need to be isolated at incomers.
In all cases there must be the same number of Isolation Confirmation Certificate as items of equipment. Isolations must be performed under the supervision of a Senior Authorized Electrical Person.

5.3.4 Switchboards (busbar)

All HV switchboards (11 or 3.3 kV) are composed of two busbars, A and B, which can be Interconnected by means of a bus-tie circuit breaker.
Isolation of busbars is strictly electricians' work but, as this may have consequences on running plant, preparatory works are of prime importance to ensure a minimum of disturbance to running equipment.

Such works should not take place more than once in every three to five years and should ideally be planned during an area shutdown although this may not always be possible.

This procedure considers this last case scenario, i.e., out with an area shutdown period.

This type of isolation must be performed under the supervision of a Senior Authorized Electrical Person after development of a detailed Procedure agreed by the Operation Supervisor.

This Procedure must highlight:

- Actions by Operators to put the plant in a safe running condition.
- Possible risks and hazards.
- Back-up solutions in the event of a failure.

Main actions and responsibilities to complete preparatory work and begin maintenance work are shown in the following Table :

ACTIONS	RESPONSIBILITY / LOCATION
All preparatory works	Certified Electricians
Switching (to ensure that all switchboards depending on bus to be isolated) are fed by alternate source	Certified Electricians

Position change-over enable / disable control switch to the OFF position.	Switchboard location electrician
Open primary circuit breaker of transformer supplying the bus bars to be worked on. Busbar is now de-energized.	Certified Electricians
Every circuit breaker movement must be confirmed by radio or telephone.	IPCS console operator
All VCB &VCS and related contactors must be removed from cubicle (including bus-tie breaker).	Switchboard location electrician
Shutters at bus-tie breaker compartment must be locked with safety padlock.	Certified Electricians
Certain keys must be retrieved to allow earthing of busbars. (See attachment-1: key interlock diagram)	Certified Electricians Switchboard location electrician

5.4 LV Equipment Isolation

5.4.1 Motor Feeders

At this voltage level (415 V) isolation consists only of locking-off the main control device (motor starter or contactor).

Control device locking-off consists of racking out breaker / contactor and applying safety padlock(s) at appropriate location(s) in such a way that racking-in is impossible without removing the safety padlock.

This type of isolation (locking-off) is only performed by a Competent Electrical Person.

If the scope of work involves removal of the motor from site, then the preparatory work must also include disconnection of cables at the motor.

This fact must be clearly mentioned on the Permit to Work or Isolation Confirmation Certification.

5.4.2 Switchboards

There are three types of switchboards:

- Switchboards comprising two busbars and a bus-tie circuit breaker.
- Switchboards with only single busbar and double feed.
- Switchboards with only single busbar and single feed.

SWITCHBOARD TYPE	DETAILS
Two busbars and bus-tie circuit breaker	These are isolated using the same principles as HV switchboards (refer 4.3.4) but earthing of busbars is performed using approved portable earthing devices made of flexible cables ending with C clamp type connectors. Such isolations are performed under the supervision of an Authorized Electrical Person.
Single busbar and double feed	These are isolated same as Two busbars and bus-tie circuit breaker type mentioned above.
Single busbar and single feed	These are isolated same as Two busbars and bus-tie circuit breaker type mentioned above.

5.4.3 UPS

In principle, UPS systems (whether DC or AC) are critical items that cannot be isolated entirely.
Maintenance teams may only begin work after preparation of concerned area is completed under the supervision of an Authorized Electrical Person and proper limitation of access is documented. Because of the presence of batteries in these UPS systems, it is possible to be exposed to contact with voltages that are hazardous to the human body.

5.4.4 Distribution Boards

Small power distribution boards can be isolated as for motor feeders when it is necessary to work on common bars or wiring.

Isolation of individual out goers from such switchboards by use of safety padlock will also need a suitable locking device fitting to concerned circuit breakers to prevent accidental closure.
As with UPS units, shutdown of associated distribution boards may not be possible without a major upset to the running plant.
Maintenance works may have to be done in live conditions, in which case a limitation of access must be prepared and documented before starting work.

If a shutdown is unavoidable, a procedure detailing other disciplines specific works requires to be

prepared and agreed before the shutdown can take place.

5.5 De-Isolation

De-Isolation is the reverse process of Isolation and consists of:

- Removing all safety padlocks and tags.
- Restoring all open and racked-out, or closed (earth switches), switching devices to working order.
- Cancelling / closing all documents.
- Updating log books etc.

This process can take place only when Working Party has declared the work is complete or if requested to do so by the shift authority.

Responsible Persons are the same as for Isolation.

Permits to Work is cancelled by Shift Authority only after running tests have been successfully conducted.

If running tests are not conclusive, and it is not possible to complete trouble-shooting or repair work on the spot, Isolations must be re-instated as they were originally and new documentation must be prepared.

6.0 References

- Electrical - Safety-Related Work Practices -- OSHA Standards 1910.331-1910.335A
- Lock Out/Tag Out Procedure Doc No 5578-E3-HSE-HU-00039
- Permit To Work Procedure Doc No 5578-E3-HSE-HU-00042
- Electrical Safety Rules Doc No 5578-E3-HSE-HU-00041.

Attachment-1: key interlock diagram

To be update